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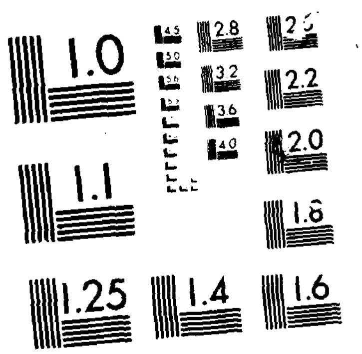

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PROJECT METEOR
SAN NICOLAS ISLAND
SITE SURVEY

FPO-1-77(17, VOL. III)
JUNE 1977

(Prepared for
Naval Research Laboratory Code 8322 B)

OCEAN ENGINEERING
AND CONSTRUCTION PROJECT OFFICE
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
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the project involved the installation of a jack-up research barge, with meteorological instrumentation attached, to gather data. Previously, such a barge as the SIR ROBERT had been used successfully in the Chesapeake Bay. The SIR ROBERT was shipped to the West Coast for the continuation of Project METEOR. The plan called for the installation of SIR ROBERT offshore the northwestern end of San Nicolas Island to provide a platform where meteorological measurements could be made, free from surf and island atmospheric effects.

Preliminary design studies were conducted to determine the design modifications which would be necessary to utilize the movable jack-up barge, SIR ROBERT, as a fixed-location, gravity-stabilized instrument platform at San Nicolas Island. The engineering design and analysis work are reported in Volume II of Report FPO-1-77(17).

The overall Executive Summary of the work accomplished for this project is presented in Volume I of Report FPO-1-77(17).

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INTRODUCTION

1.1 BACKGROUND

Project METEOR is the code name for experiments that determine the behavior of a laser beam through the marine atmosphere. San Nicolas Island, off the California coast, was chosen as a project site because the atmosphere on the island's northwest coast exhibits minimal terrestrial effects. Part of the project involved the installation of a jack-up research barge, with meteorological instrumentation attached, to gather data. Previously, such a barge, the SIR ROBERT, Figure 1-1, had been used successfully in the Chesapeake Bay. The SIR ROBERT was shipped to the West Coast for the continuation of Project METEOR. The plan called for the installation of SIR ROBERT offshore the northwestern end of San Nicolas Island to provide a platform where meteorological measurements could be made, free from surf and island atmospheric effects.

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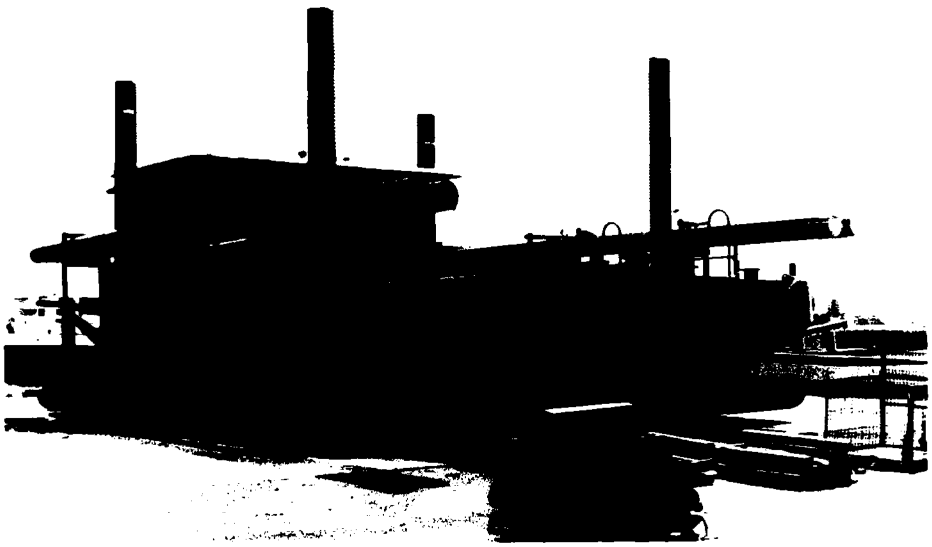


Figure 1-1. Jack-up Barge SIR ROBERT

1.2 TASKING AND ORGANIZATION.

In response to tasking by the Naval Research Laboratory (NRL), the Ocean Engineering and Construction Project Office, Chesapeake Division, Naval Facilities Engineering Command (CHESNAVFACENGCOM), executed a site survey at San Nicolas Island to determine the best location for the installation of the research barge. Operations were directed by E. C. Escowitz, Ocean Environment Specialist, CHESNAVFACENGCOM. Assisting in the site survey were: S. Mendelsohn, General Engineer, CHESNAVFACENGCOM; D. Fitzgerald, Beach Geomorphologist, University of South Carolina; LT T. Christensen, CEC, USN, Marine Technology, Office of Naval Research; H. Herrmann, Soils Engineer, Civil Engineering Laboratory. The Commands and organizations involved in the survey and their relationships are shown in Figure 1-2.

Diving support to the survey was provided by Reserve Harbor Clearance Unit-1 (HCU-1), San Diego. The divers were commanded by LCDR R. Jones, USNR. After CHESNAVFACENGCOM cleared HCU-1 participation with NAVRES, New Orleans, HCU-1 proceeded to initiate action to get patrol boat (Coastal River Squadron One-NR) and air (COMNAVAIRPAC-HC3) support for the operation.

1.3 OBJECTIVES.

It was originally planned to use the SIR ROBERT as a fixed-location, gravity-stabilized platform for the operations at San Nicolas Island. Because of severe scouring conditions at such a shallow-water site on the weather side of an offshore island, special attention was focused on the requirements for bathymetric and subbottom soil surveys. LCDR J. Eckart of CHESNAVFACENGCOM developed the specifications for these environmental surveys, as included in Appendix A of this report. However, it became apparent that the extreme wave and seafloor scour conditions would preclude a gravity-stabilized platform approach, and the requirement for subbottom soil profile data was deleted as an immediate survey objective.

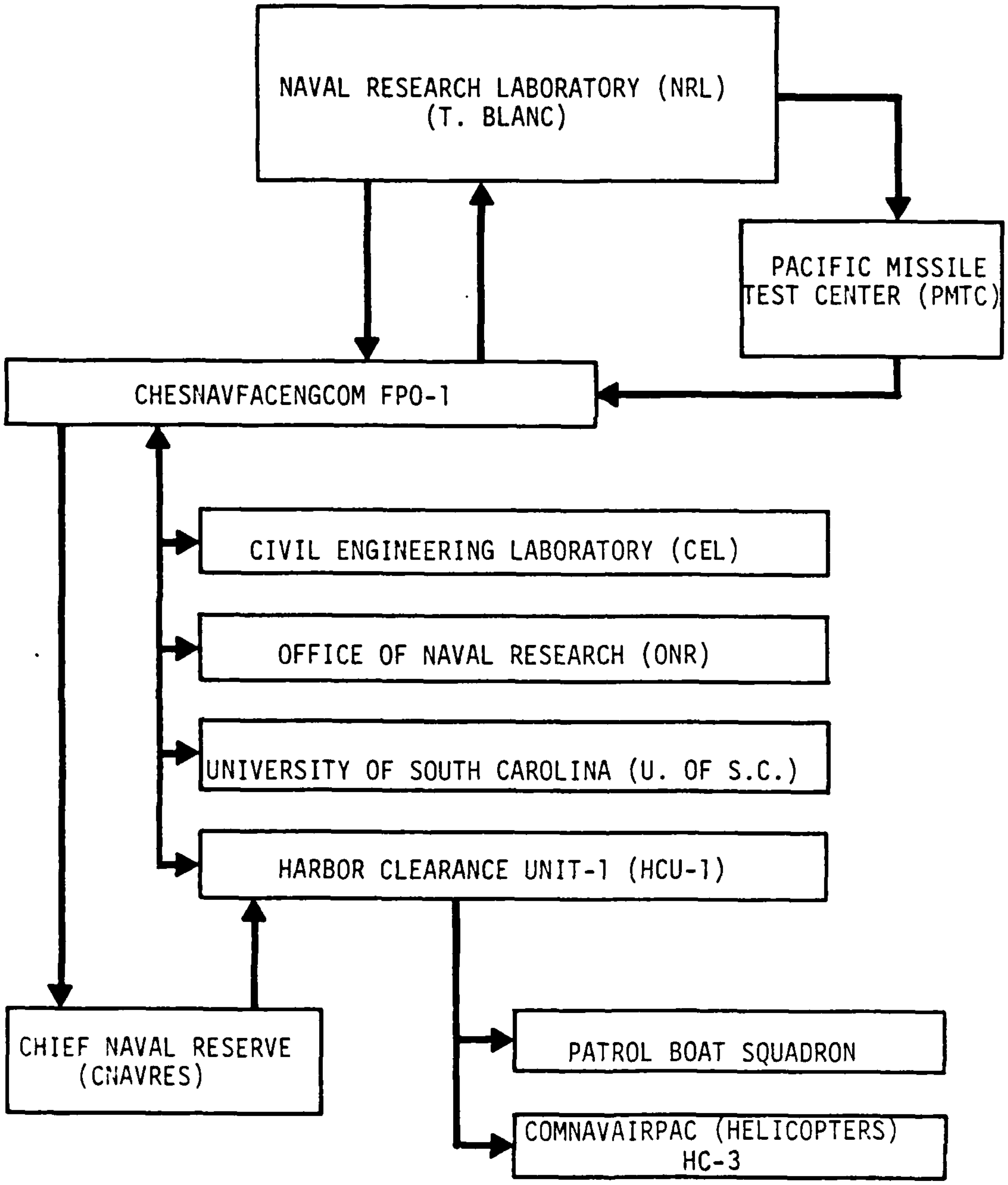


Figure 1-2. Commands and Organizations Involved in the Site Survey

The objectives of the actual site survey were to: (a) assess the environmental conditions at the primary siting areas to allow an engineering approach for the installation of the SIR ROBERT to be developed; (b) select a specific site for SIR ROBERT's installation; and (c) determine the environmental design criteria for the selected site. Discouraging initial findings for a marine site caused a modification of the survey's efforts. When it became apparent that the possibility of using SIR ROBERT was waning, consideration was given to a land site.

1.4 CONSTRAINTS.

Initial constraints to the siting required that: (a) the SIR ROBERT, when operational, have an unobstructed aspect to the northwest wind; (b) the SIR ROBERT operate in a jack-up mode; (c) a cable run ashore from the operational site; and (d) environmental conditions at the site allow operations to continue through moderate weather events.

1.5 OPTIONS.

Prior to the site survey, a number of options were considered for the installation of SIR ROBERT at San Nicolas. What remained to be determined in the site survey was whether the SIR ROBERT could be ins.alled safely and maintained in a cost-effective fashion. The significant installation options were to:

a. Install SIR ROBERT as a fixed gravity structure at a particular site and run a cable ashore.

b. Moor SIR ROBERT at a safe location, move the barge to a selected site when cperational, and fix a cable from shore to buoy system.

c. Jack up SIR ROBERT at a safe location, move the barge to the site when operational, fix a cable from shore to buoy system.

d. Moor and jack up the barge at a safe location (combination of b and c).

e. Add wheels to SIR ROBERT, roll it up onto the beach, and fix a cable to buoy system.

f. Add a removable or permanent ramp to the beach and follow subparagraph e.

g. Build a ramp with a rail car trailer to remove SIR ROBERT. Fix a cable to buoy system.

1.6 SITES.

Six sites were visited, and are identified in Figure 1-3 as I through VI. Site VI, the last site to be considered, is a land site.

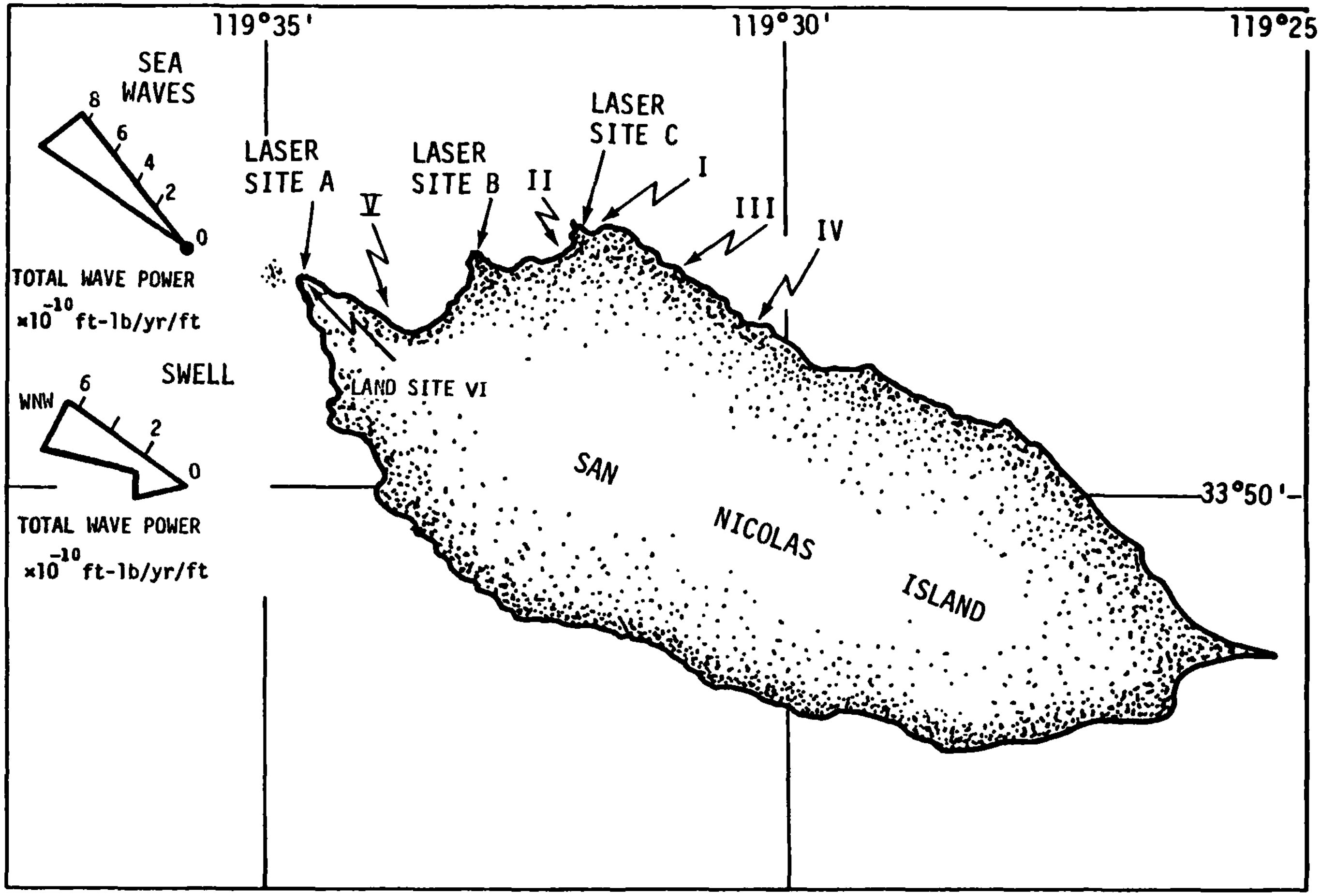


Figure 1-3. Six Prospective Meteorological Tower Sites

SECTION II
PHYSICAL SETTING

2.1 LOCATION.

San Nicolas Island is one of eight channel islands which lie off the Southern California coast between Santa Barbara and San Diego. It is the outermost island of the group and is located 145 kilometers southwest of Los Angeles. The island covers 83.7 square kilometers and its long axis trends WNW-ESE.

2.2 DESCRIPTION.

The rocks of San Nicolas Island consist of a thick sequence of alternating marine siltstones and sandstones. These turbidite deposits are Eocene in age and were uplifted during mid-Miocene. A detailed geological investigation of the island was performed by Vedder and Norris, 1963.

The irregular shoreline of San Nicolas Island is mostly rocky with small pocket beaches between rock promontories. Shore cliffs, chasms, rock terraces, and a large cuspate spit are all features of the coastline. The beaches have a variable composition with the following types noted: (a) fine to medium coarse sand; (b) shell litter; (c) shell hash; (d) spherical, well-rounded andesitic pebbles, 1.5 centimeters in diameter; (e) disk and blade-shaped, well-rounded, sandstone pebbles, 1-10 centimeters in diameter; and (f) combinations of the above. The intertidal portion of the rocky shoreline has been highly modified by wave and biological activity. Differential weathering has produced well-rounded, irregularly-shaped boulders up to 2 meters in length. In other locations, the boulders are smaller (20-40 centimeters) and have been

intensely bored by sea urchins, abalone, limpets, snails, and encrusting algae.

2.3 TIDES.

The semidiurnal tides at San Nicolas Island have a mean range of 1.1 meters and a 1.5 meters range during spring tidal conditions.

2.4 WAVES.

Rose diagrams in Figure 1-3 indicate that the sea waves come from the dominant northwesterly wind direction, while the swell waves come predominantly from a west-northwesterly direction. This information was taken from a study done by Johnson et. al. (1971) for a station 35 kilometers directly north of San Nicolas Island, in which wave parameters were determined by a hindcast procedure using meteorological data from 1956 to 1958. Summary of wave data, Table 2-1, from a Data-well wave buoy implanted near Begg Rock (northwest of San Nicolas), shows that the average wave height for this area (deep water) ranges from 0.95 meters in April to 2.13 meters in March and the significant wave height range is 1.55 to 3.44 meters for the same months. The summary of synoptic Meteorological Observations (prepared by the Naval Weather Service, Asheville, N.C.) indicates that the average wave height, Table 2-2, for the general area ranges from 1.8 to 2.1 meters throughout the year. Wave accelerometer data from the Thousand Springs Cove area (Site I, Figure 1-3) during the week of 10 April 1977 showed extremely high average wave heights, 2.0 to 2.5 meters.

2.5 CURRENTS.

The WNW-ESE trend of the island, coupled with a dominant west to northwesterly wave direction, cause longshore currents (estimated to be 40-80 centimeters per second on 16-17 April 1977) to move southeasterly along both sides of the island. Evidence of the effects of these currents is a large accumulation of sand in the form of a cuspate spit on the island's southeastern extremity.

TABLE 2-1. SUMMARY OF WAVE DATA FROM DATAWELL BUOY NEAR BEGG ROCK (30° 22'N 119° 41.5' W) FROM 1 APRIL 1972 THROUGH 31 DECEMBER 1973 (ref 3)

Month	Lowest Monthly 3-Minute Ave. Period (Sec.)	Average Wave Ht. (m.)	Computed Ave. Significant Height (m.)	Highest Monthly 3-Minute Average Average Height (m.)
Jan	5	1.77	2.83	3.96
Feb	6	1.52	2.44	2.74
Mar	5	2.13	3.44	3.96
Apr	4	0.95	1.55	2.44
May	5	1.04	1.65	3.05
Jun	5	1.19	1.92	3.66
Jul	4	1.13	1.80	1.83
Aug	5	1.16	1.86	2.44
Sep	6	1.40	2.23	3.66
Oct	5	1.19	1.92	2.74
Nov	5	1.80	2.93	3.05
Dec	5	1.52	2.47	3.66

TABLE 2-2. AVERAGE MONTHLY WAVE HEIGHTS (ref 1)

Month	Average Wave Height (Meters)
January	2.12
February	2.07
March	2.10
April	2.12
May	1.95
June	2.07
July	2.05
August	1.91
September	1.80
October	1.85
November	1.07
December	2.10

SECTION III
CHRONOLOGY OF EVENTS

3.1 THURSDAY, 14 APRIL 1977.

Investigation of the sites began. Site I was the first to be examined. The survey party proceeded to the northernmost point of the island, and from the high ground, inland of the back beach, made observations of the surf conditions. Particular attention was given to the distance from shore of the breaking waves and the pattern of the breakers. Moving down closer to the Site I region, observations were made of breaking wave amplitude. Bearing capacity of the Thousand Springs Cove Beach was measured with a Geostick, and photographs were taken of the area.

Following the assessment of Site I, attention was focused on the region southwest of Laser Site C (Figure 1-3). This area, which was identified as Site II, received the same type of scrutiny as Site I. At both sites there was extensive mist from the breaking waves.

3.2 FRIDAY, 15 APRIL 1977.

In the morning, the survey again focused on the Thousand Springs Cove region. The winds were easterly and the surf conditions were considerably lower than the previous day. Waves were still breaking 500 meters from shore. The survey then moved to Site III on the northeast side of the island. This area was examined as a potential primary site and as a possible storage area for the barge. Getting close to the water was extremely difficult because the coast is very rocky. Most of the observations at this site were made from the high dune area inland of the rocky scarps of the coast.

In the early afternoon, the survey group visited the recording station for the wave buoy in Thousand Springs Cove. The data available was comprehensive for the previous week and indicated that the wave heights averaged greater than 2 meters. It was deduced that conditions observed at the Sites thus far were typical for the week. Wave conditions were also in line with climatic statistics.

The survey efforts were then focused on the Site IV area. Extremely rocky conditions, not unlike Site III, were encountered. This deterred close examination of individual coves. In spite of the inability to get close to the shoreline, a general assessment could be made of conditions and site potentials.

Site VI was examined in mid-afternoon as a possible land location for an instrument tower. Some emphasis was being placed on the selection of a land site at this time. This was due to the severity of the coastal conditions which made use of SIR ROBERT unlikely. From Site VI, the survey group walked along the southwest shore of Laser Bay. It was observed that the surf conditions were less severe in the inner part of the bay. This area, Site V, was selected as a possible site for SIR ROBERT's installation. A diver survey of the seafloor was proposed and there was mutual agreement that this site was the only possibility for SIR ROBERT.

3.3 SATURDAY, 16 APRIL 1977.

On Saturday morning, another visit to Site V was conducted. The surf conditions were low and an outline for the diver operations was developed. It was decided that floats should be deployed along the 6 meters contour, thus providing reference points to orient the diver survey. Upon returning to the airport, it was discovered that the Harbor Clearance divers would be late arriving due to helicopter problems.

The diving team arrived about noon and were transported to the barracks. A briefing was held at the barracks and the specific objectives of the survey were presented. Following the briefing, the survey party and divers departed for the Laser Bay site area. On the beach at the site area, preparation was made to send a rubber boat through the surf to deploy the marker floats. This effort proved to be successful. Three reference points were marked with buoys and identified as x, y and z, Figure 3-1. Establishing the site area and implanting the floats took more time than expected, daylight was fleeting, and it was decided that operations be terminated for the day.

Saturday evening was devoted to reviewing the operations planned for the next day. The plan that evolved required the team to split into two groups. One group, 26 divers, would board the two patrol boats supporting the operation on the northeast side of the island. This group would come around the island and approach the site from the sea. A second team, including the survey group, would launch a boat from the beach and make a reconnaissance dive at the site. The reconnaissance information would be used to guide the survey work of the group arriving by boat.

3.4 SUNDAY, 17 APRIL 1977.

Upon reaching the site area beach on Sunday morning, it was apparent that the surf condition would be a problem. A reassessment of the site was made, and the y to z region was eliminated from consideration due to hazardous surf conditions. A dive was commenced at point x and completed at point y. This dive was executed by Christensen, Herrman, and Fitzgerald. As this dive was being completed, the patrol boats arrived with the other team, Figure 3-2. The reconnaissance survey dive had located one area which had potential as a site. This was marked with a float and the diving team was instructed to swim in a detailed pattern around this float and to note all bottom features.

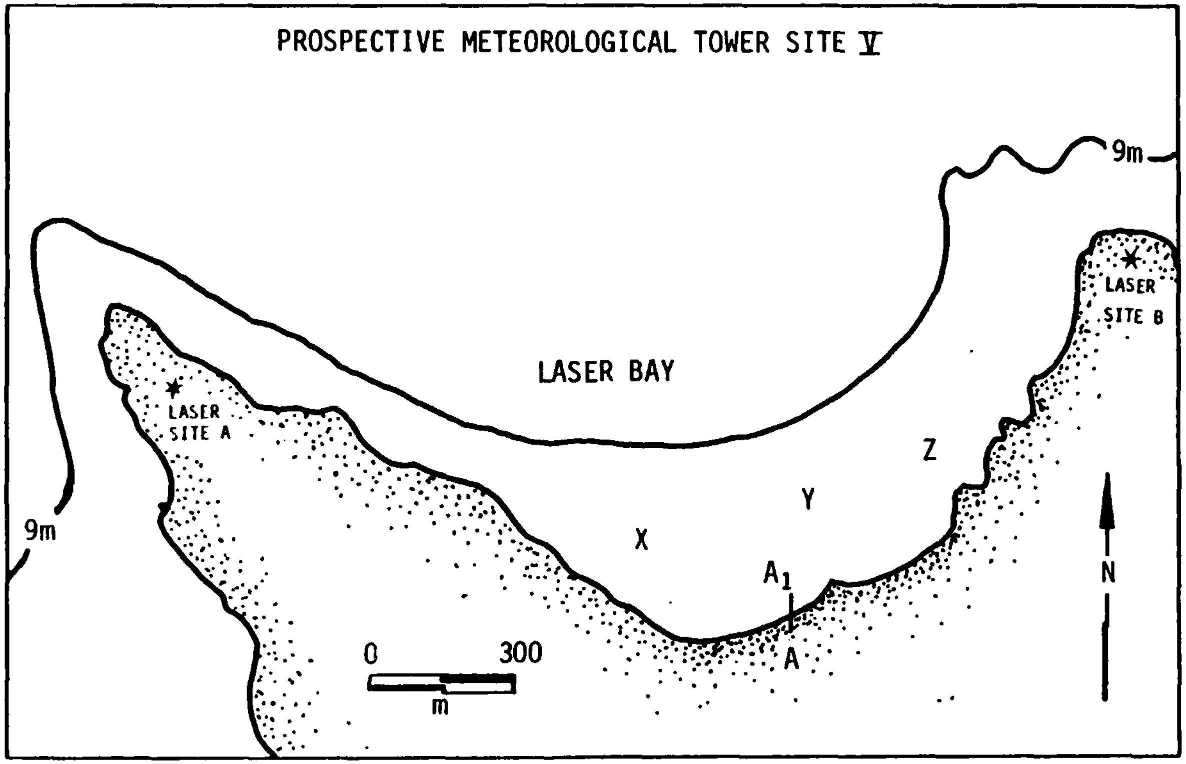


Figure 3-1. Reference Points at Laser Bay. Also shown is the location of the beach cross-section A to A_1.

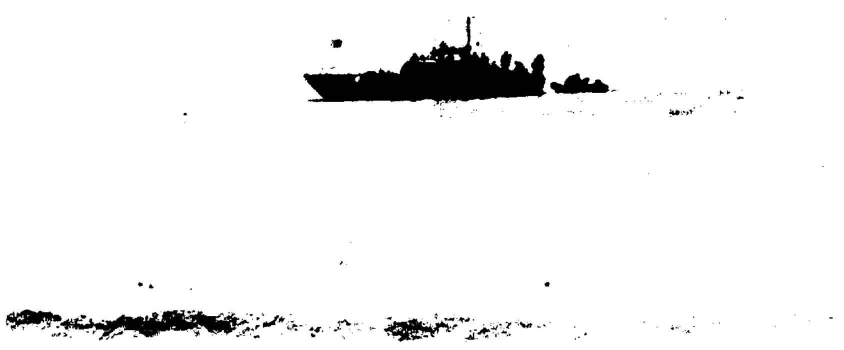


Figure 3-2. Divers Arrive in Patrol Boat

Diving was terminated by mid-afternoon and the divers departed via helicopter.

3.5 MONDAY, 18 APRIL 1977.

The survey group held a meeting to summarize their observations. The unanimous opinion was negative regarding the use of SIR ROBERT offshore San Nicolas and positive regarding the use of a land site (near Laser Site A).

SECTION IV
SITE SURVEY RESULTS

4.1 SITE I.

Site I (Figure 1-3) was located in Thousand Springs Cove at the northwestern corner of the island. The cove is positioned between two rock headlands and is backed by a relatively steep beach (Figure 4-1) of medium to coarse-grained sand. Bearing capacity determined with the Geostick of the beach-face and low tide terrace (lower beach) was 12 lb/in.^{2}, while that of the neap and multiple storm berms was 10 lb/in.^{2}.

The irregular offshore bathymetry, coupled with rough surf conditions, make this area an unlikely location for SIR ROBERT. On 14 April 1977, waves were breaking 400-600 meters offshore, Figure 4-2. A wave accelerometer located in the cove recorded 10 second waves with heights of 2-2.5 meters during the observation period, which is normal for this coastline. Due to the geometry of the cove, wave reflection, diffraction and refraction can cause constructed interference of the wave crests. The wave accelerometer record has shown that waves of up to 8-8.5 meters occurred in the cove region. A jack-up barge in this type of wave climate is infeasible.

4.2 SITE II.

Site II is located just west of Thousand Springs Cove between two promontories (Figure 1-3) which are Laser Sites B and C. The bay has a relatively wide beach (150-250 meters) which grades into a vegetative dune field. The beach sand is medium to coarse-grained with a Geostick bearing capacity ranging from 8 to 10 lb/in.^{2}.

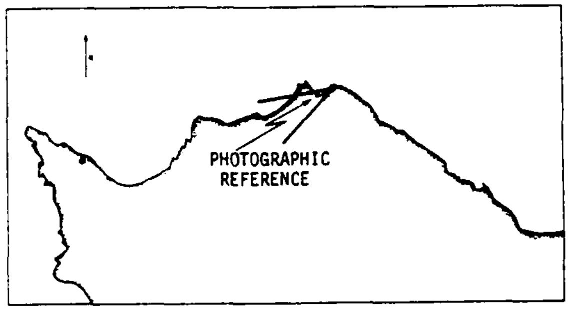


Figure 4-1. Beach at Thousand Springs Cove

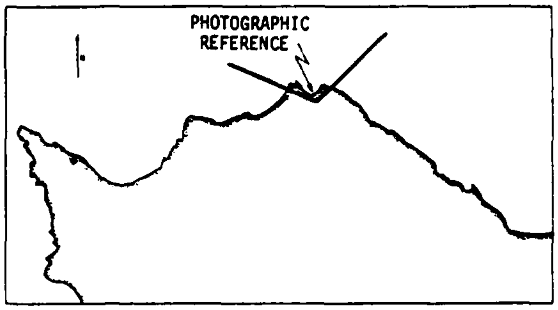


Figure 4-2. Composite View of Thousand Springs Cove

On 14 April 1977, during average conditions, the breaker zone in this area extended from the beach seaward approximately 500-700 meters. Positioning and operating the SIR ROBERT in this type of wave climate would be treacherous. Evidence of this fact is the wrecked barge grounded on the beach in Figure 4-3.

4.3 SITES III AND IV.

Sites III and IV are located on the northeast side of the island. The Site III location is a region where numerous coves, normal to the island shoreline, exist. One cove in particular, Figure 4-4, which was formed by a natural rock groin, was considered as a potential permanent installation or temporary storage site for SIR ROBERT. Although this area is protected from dominant swell direction, longshore currents in this region would make handling of the barge extremely hazardous. Surf conditions would add to maneuvering difficulties on all but the calmest days.

The Site IV region (Figure 4-5) was explored in search of a better cove. The conditions and hazards were almost the same as at Site III. One alternative considered was the use of an instrument array that would be suspended across the cove (Figure 4-5). This idea was dismissed because the wind field visible to the site was northwest to north, whereas the project requirement was the entire west to north quadrant.

4.4 SITE V.

Site V was located at Laser Bay on the northwestern end of the island (Figure 1-3) between Laser Sites A and B. The bay is partially protected from west to west-northwesterly swell waves by a large promontory and by shallows which form the bay's western boundary. Central Laser Bay is backed by a 100-meter-wide beach of medium-sized sand. The beach has multiple berms which grade landwardly into a steep sloping vegetated dune field (Figure 4-6). To the east and west, the beach narrows to a rocky shoreline, Figure 4-7.

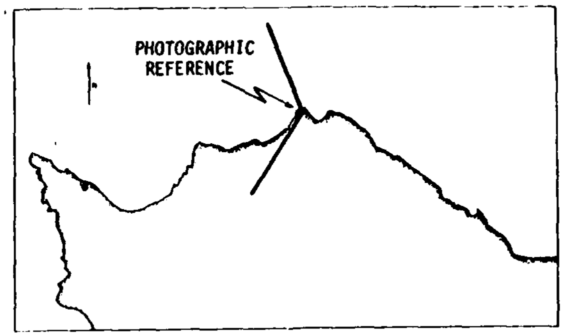


Figure 4-3. Composite View of Beach Area Southwest of Laser Site C

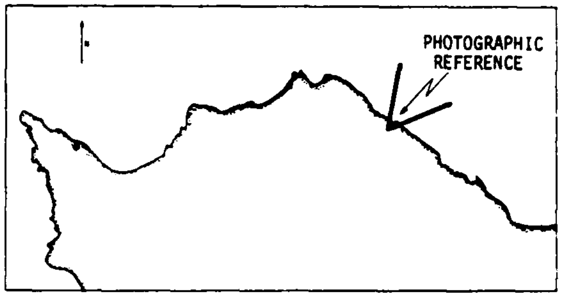
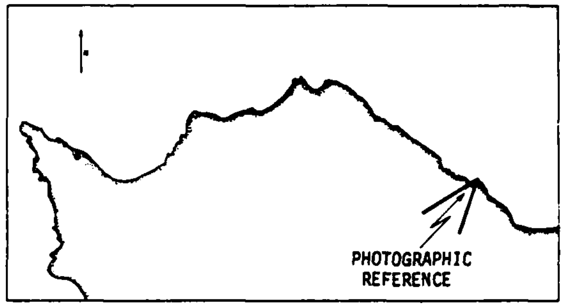


Figure 4-4. Cove at Site III Location



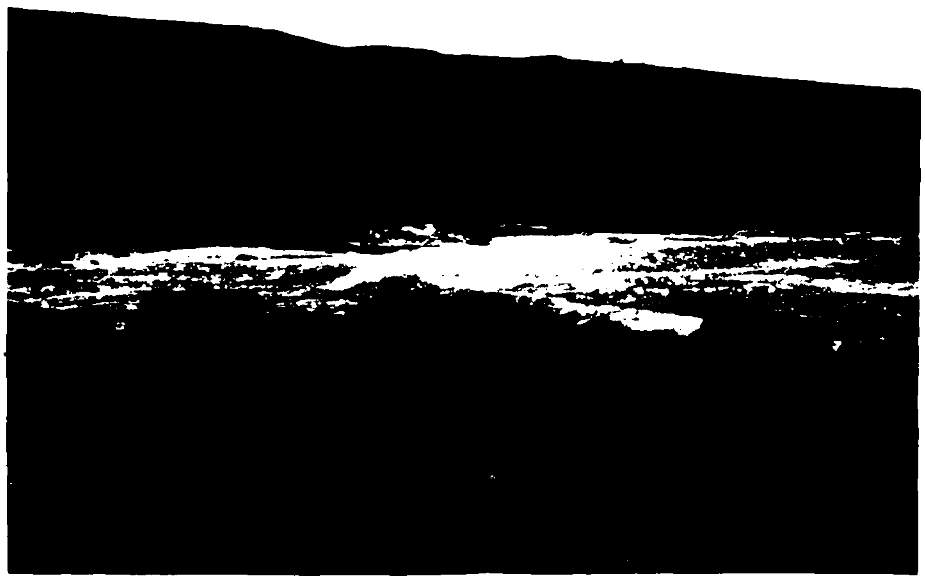


Figure 4-5. Cove Area (Site IV) on Northeast Side of Island

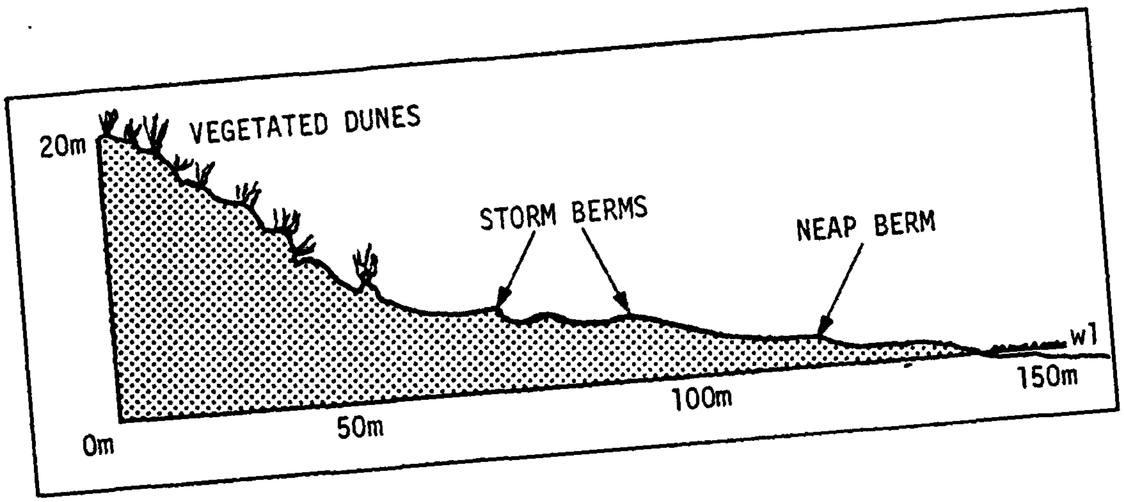


Figure 4-6. Sketch of Laser Bay Beach

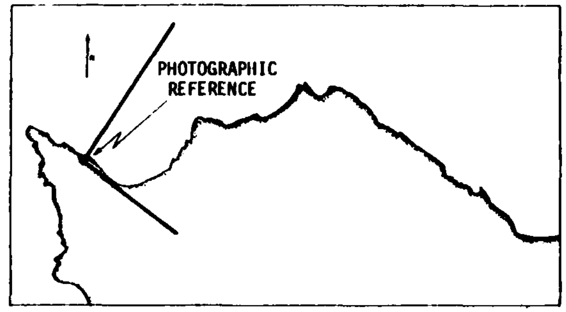


Figure 4-7. Composite of Laser Bay

On 15 April 1977, wave heights were 1.0-1.5 meters, and the bay appeared calm with a narrow breaker zone close to shore. Because this site looked favorable for a jack-up barge, the offshore area was surveyed in more detail by SCUBA divers. Three marker buoys, X, Y and Z (Figure 3-1), were positioned on the 6-meter contour line on 16 April 1977. The following day, dives were made along the transect line from X and Y; the area between Y and Z was abandoned due to breaking waves in this region.

A sketch of the bottom is shown in Figure 4-8. At buoy X, the seafloor was flat with less than 30 centimeters of relief. The bottom was composed of siltstones and seaweed with scattered cobbles (5 to 20 centimeters in length) and a dusting of sand. The swell in this area at the time of the dive was 1.0-1.5 meters, which caused a strong landward surge on the bottom. Moving toward buoy Y, relief increased to 30-60 centimeters and sand was more abundant. Sand was found filling 40-60 centimeter-wide and 15 centimeter-deep channels oriented obliquely to the shore and in small patches on the leeside of local relief, protected from the landward wave surge. Two larger sandy areas were also located along the transect, one about 6 meters across and another at least 20 meters across and large enough to accommodate the SIR ROBERT. The latter region was flat and covered by linear ripples with average heights of 3 centimeters and wavelengths of 12 centimeters. A core through the middle of the flat indicated the sand was at least a meter deep with very little vertical grain size variability (.25-.35 millimeter). The top 10 centimeters of the core was homogenous, which probably indicates the depth of reworking by benthic organisms or wave and current action. From 10 to 30 centimeters down, fine laminations of coarser sand were present. These coarser sediments may represent a lag deposit which resulted from storm erosion. Below 30 centimeters, the sand was grayish black, caused by a reducing environment and indicative of an unstable zone.

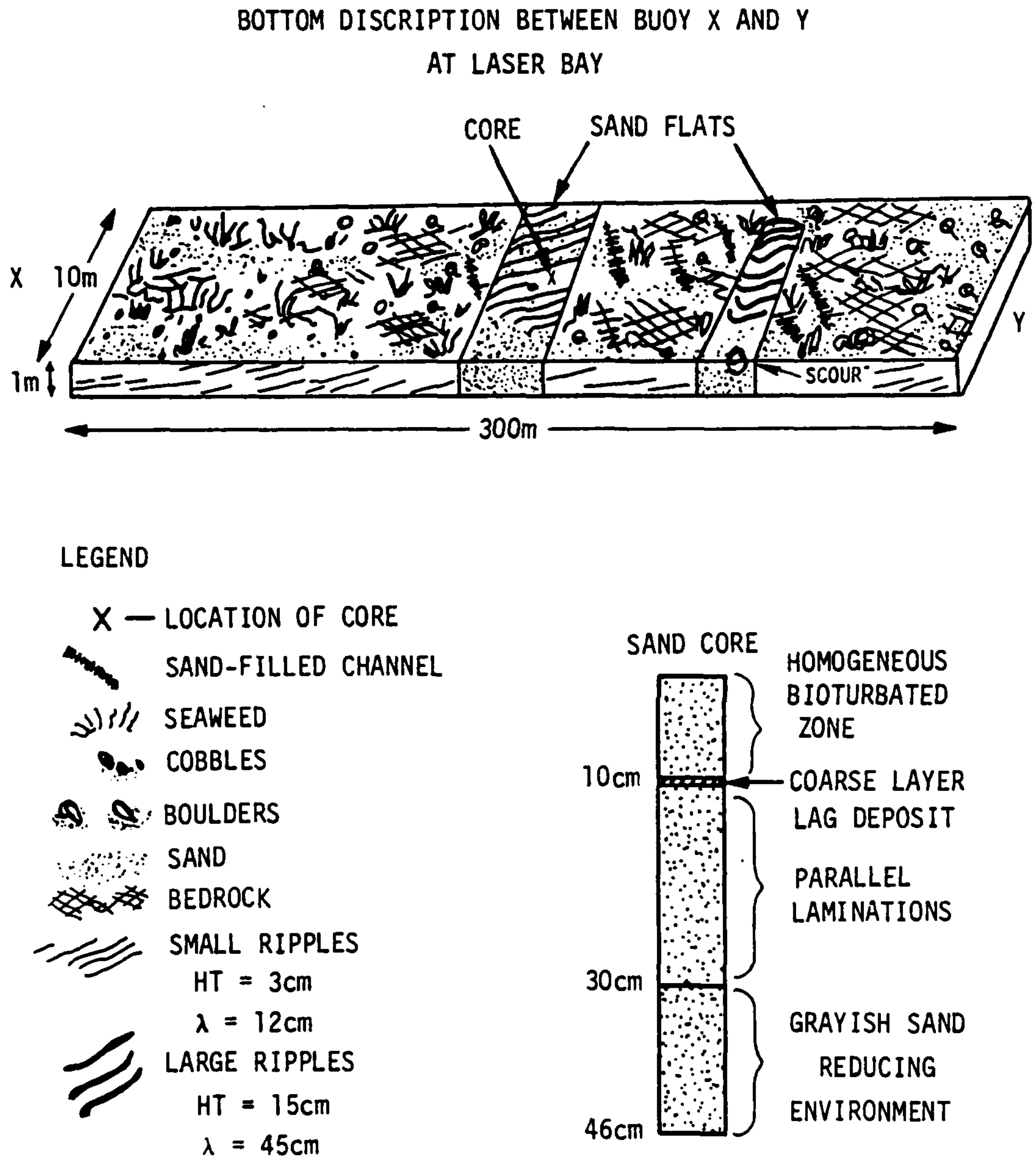


Figure 4-8. A Sketch of the Sea Floor. (Made along the transect between buoys X and Y, constructed from SCUBA diver observations. A 46 cm core was taken from the middle of the large sand flat.)

It is certain that if the jack-up barge were positioned on the sand flat, severe scour would follow. A large boulder, 1.3 meters across, situated at the landward end of the smaller sand flat has 70 centimeters of scour around it. During times of storm activity, wave surge would cause deeper erosion around the barge's bottom structure, the superstructure would be pounded by waves, and the rig could possibly topple. This location cannot be recommended for the SIR ROBERT.

4.5 SITE VI (LAND SITE).

Site VI was a land site situated on the northwestern tip of San Nicolas Island. Along the shoreline in this area are large boulders (Figure 4-9) setting on a rock terrace. The boulders have been moved to their present location by wave action. The wave forces should be considered when the meteorological tower is designed. It may even be speculated that a boulder could be rolled or thrown against the tower structure if the topography around the tower were leveled.

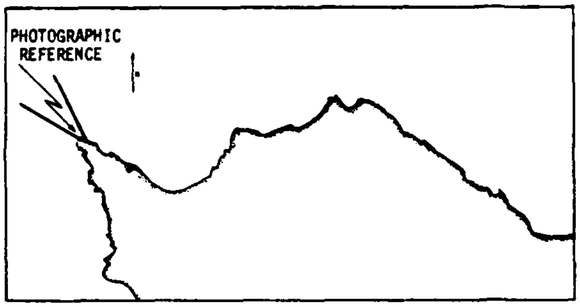


Figure 4-9. Northwest Tip of Island Site VI (Land Site)

SECTION V
CONCLUSIONS

- The SIR ROBERT, as a fixed gravity structure, is unsuited to the wave climate around the northwestern end of San Nicolas Island.

- Cove penetration resistance gradient (G in MN/m^3) measurements were less than 10 for most of the beach areas examined. Therefore a roll-up on the beach concept was dismissed.

- Using the barge as a mobile jack-up structure, even during calm periods, seems impractical due to foreseeable positioning problems, storage problems, and unpredictability of the weather and sea state.

- The northern side of the island has strong longshore currents, and consequently, positioning and handling of the barge in this area would be difficult. The coast in this region is extremely rocky and poses an additional hazard in the event of maneuvering crisis.

- Unless a different type of offshore structure is possible, a land site is strongly suggested for the meteorological tower. The promontory, Site VI, on the northwestern end of the island looks favorable. If this site is chosen, some consideration should be given to the wave forces and the possible movement of large boulders in this region.

APPENDIX A
SITE SURVEY GUIDELINES

PREPARED BY

LCDR J. ECKART, CEC, USN

APPENDIX A
PROJECT METEOR
BOTTOM SURVEY AND FOUNDATION INVESTIGATION

A.1 PURPOSE.

To evaluate possible emplant sites for the 20 ft x 40 ft jack-up barge SIR ROBERT. This barge will be used as a field laboratory for Project Meteor experiments.

A.2 GENERAL.

a. It is desired that the selected site be as close as possible to the shore line at Site C, consistent with restrictions established below. The proximity to Site C is necessary to facilitate support of the experiment with shore power and communications from the PMTC installation.

b. The site is to be located in Thousand Springs Cove or on the next beach immediately West of the cove, since such siting would be near the optical path of instruments already installed at Site C.

c. The site selected and final installation design must have no surf up wind of structure nor in its vicinity for design wave conditions. This is necessary in order to minimize the presence of surf generated aerosols which distort experimental measurements.

d. Since the jack-up barge has a mat foundation which will require loading of the mat with rock to improve stability, the foundation will be required to substain a fairly heavy load up to a maximum of about 800 lb/sf.

A.3 SCOPE OF SITE WORK.

A bathymetric, sub-bottom profiling, vibrating-coring, and bottom reconnaissance survey shall be conducted. The general area to be surveyed extends from the shoreline to 2000 feet offshore and extends approximately 3000 feet along the shoreline of the island. The site survey should be completed in the order that follows:

a. Bathymetric Survey: The bathymetric survey shall be performed with a recording fathometer that has a vertical resolution of ±.5 feet. The grid pattern should be on a 100 ft by 100 ft spacings in the survey area. Since the objective is to find a site as nearly flat as possible, when such areas appear on the survey they should be marked and double checked by a diver.

b. Sub-Bottom Profile: The sub-bottom profile shall be performed with an acoustic sub-bottom profiler and should follow on a similar grid to the bathymetric survey. The sub-bottom profile should extend to approximately forty feet below the bottom and reveal presence of rock or clay under the sand layer.

c. Vibra-corer: After potential sites for further consideration have been identified by the CHESDIV project engineer, two vibra-cores shall be taken at each site to confirm foundation conditions.

d. Bottom-Reconnaissance Survey: A bottom survey shall be conducted by a diver of each potential site designated by the CHESDIV Project Engineer and along a potential cable path from the site to shore. Grab samples of bottom material should be taken as appropriate and rock outcroppings or other hazards to cable should be noted. Each area should be checked for signs of erosion in bottom materials.

e. Horizontal controls for the survey sufficient to achieve ±3 ft accuracy shall be established using the miniranger and range poles as appropriate. Details of the horizontal controls used and the accuracy achieved should be included in the survey report.

A.4 LABORATORY WORK.

Samples collected by divers or from vibra-cores are expected to be cohesionless materials and will be disturbed by the sampling process. Samples should be tested for gradation, presence of calcarious materials, range of relative densities, bulk densities, and main constitutents of the sand, i.e., quartz, feldspar, shell fragment. A direct shear test should be run on three intermediate sand densities to obtain a representative Ø angle for the sand. If cohesive soil is encountered, triaxial shear and consolidation tests should be performed on representative samples.

A.5 REPORT.

The report should include:

The sub-bottom profile for each site should be given for an area 200 ft x 200 ft centered on the site center. A profile of the vibracorer results for that site should be included with the sub-bottom profile, and correlated to it.

A topographic map of the bottom in the survey area shall be prepared from the bathymetric survey and drawn to a one ft contour interval.

Laboratory test results on soil samples should be collected by site and evaluated. A recommended bearing capacity of the bottom, and expected range of settlement should be included.

Diver's reports on the bottom survey at each site and cable route should be included in the report.

A.6 SCHEDULING.

Preliminary data for design purposes should be informally provided to the Project Design Coordinator, Dr. C. Chern, as soon as available, and a final report of the site survey should be submitted within one month of completion of the on-site effort.

APPENDIX B

PROJECT METEOR

SAN NICOLAS ISLAND

SITE SURVEY EXECUTION

PLAN

11 APRIL 1977

OCEAN ENGINEERING AND CONSTRUCTION PROJECT OFFICE

CHESAPEAKE DIVISION

NAVAL FACILITIES ENGINEERING COMMAND

WASHINGTON, D.C. 20374

APPENDIX B

PROJECT METEOR

SAN NICOLAS ISLAND

SITE SURVEY EXECUTION PLAN

B.1 INTRODUCTION.

The survey outlined herein is being conducted to acquire detailed environmental information on various parts of San Nicolas Island. This type of information is required prior to firm formulation of an engineering approach to the problem at hand, keeping the SIR ROBERT at San Nicolas Island. Ultimately, the environmental data to be acquired will be used to give credence to a particular engineering approach. At this time, where is a host of alternatives, it remains to be seen which one will prove to be cost effective, of lowest risk and most expeditious.

This survey is being conducted in response to a request, by T. Blanc of the Naval Research Laboratory, for engineering services. The operations will be under the direction of E. Escowitz, Ocean Environment Specialist, CHESNAVFACENGCOM. Other participants include: S. Mendelsohn, General Engineer, CHESNAVFACENGCOM; Duncan Fitzgerald, Beach Geomorphologist, University of South Carolina; LT T. Christensen, Marine Technology, Office of Naval Research; H. Herrmann, Engineering Soils, Civil Engineering Laboratory. Diving operations will be conducted by Naval Reserve Harbor Clearance Unit 419 from San Diego, California.

There are a number of schemes that can be followed to site the SIR ROBERT at San Nicolas Island. The overall concern is to do the siting in a cost effective fashion that: (a) provides safety for the

vessel when not operational; (b) allows for use at a predetermined site when operational, and (c) affords a means of maintaining the vessel.

There are a number of engineering options which can be developed. The one selected will depend on the environmental characteristics on San Nicolas Island. Therefore, it is impossible to give priority to any particular scheme prior to examination of the site alternatives. In spite of this, some of the options can be delineated. The installation options include, but are not limited to:

a. Install SIR ROBERT as a fixed gravity structure at the site where it will become operational-run cable to shore.

b. Moor SIR ROBERT at some safe location, move to site when operational, fix cable to buoy system.

c. Jack-up SIR ROBERT at some safe location, move to site when operational, fix cable to buoy system.

d. Moor and jack-up at safe location (combination of b and c).

e. Add wheels to SIR ROBERT and roll up on beach, fix cable to system.

f. Same as e only add ramp to beach (removable or permanent).

g. Build ramp with rail car trailer to remove SIR ROBERT, fix cable to buoy system.

The site survey of San Nicolas Island will be conducted with all the aforementioned elements in mind. It is the overall objective to acquire environmental data which will clearly define an engineering approach.

B.2 SURVEY OPERATIONS.

The operations planned for San Nicolas Island fall into three general areas: (a) inspection of potential sites from the water, (b) inspection of potential sites from the beach and, (c) diver inspection of the bottom. The degree to which any of these areas is pursued will depend on two things, the weather and previous findings. It is possible that weather conditions may greatly deter any or all operations. Rescheduling due to weather will be done, to the extent possible, when the occasion arises.

Much of the detailed observations will be determined by the initial findings during the first days overview of the island. The overview will be acquired by a boat survey. Following the initial boat survey, selected sites will be visited. Hopefully, all the choice sites will be accessible over land. Upon visiting the selected sites, a judgment will be made regarding the sites suitability for a particular engineering approach and an outline of a diver survey will be developed.

Diver observations will be done with the Harbor Clearance Unit split into two teams. One team will survey the operational site for SIR ROBERT. This will include examination of the proposed cable route to the expected jack-up site. The second part of the team will proceed to other sites which are being considered for SIR ROBERT storage.

Each evening a meeting will be held to review the information acquired during the day and to organize a plan for the next day's operations. A general schedule of events is as follows:

13 April 1977	A.M.	- briefings at PMTC
	P.M.	- visit SIR ROBERT - get equipment at CEL - move equipment to PMTC

14 April 1977	A.M.	- transit to San Nicolas - commence visual survey from boat
	P.M.	- continue survey - meeting for planning
15 April 1977	A.M.	- commence visual survey from shore
	P.M.	- continue visual survey from shore - meeting devise diver operations plan
16 April 1977	A.M.	- divers arrive and mobilize
	P.M.	- commence diver ops (2 sites) - debrief divers - organize material - plan ops for next day
17 April 1977	A.M.	- continue diver ops
	P.M.	- terminate diver ops - debrief divers - divers depart - plan additional efforts for next day
18 April 1977	A.M.	- land based ops for cable landing
	P.M.	- ops continue - pack equipment
19 April 1977	A.M.	- depart San Nicolas - brief at PMTC
20 April 1977	A.M.	- return equipment to CEL for shipment
	P.M.	- bring samples to laboratory
21 April 1977	A.M.	- weather day/or return to east coast or optional travel to FNWC
22 April 1977		- optional day/or return

B.3 ORGANIZATION.

The site survey will be under the technical direction of E. Escowitz of CHESNAVFACENGCOM. In that capacity he will plan and direct all operations. This will include establishment of liaison with various support commands. Included in this group is Pacific

Missile Test Center, Naval Weapons Center, and Harbor Clearance Unit 419. Assisting during the operations will be R. Ramsey from PMTC. He will serve as primary liaison to the CHESNAVFACENGCOM efforts.

B.4 REPORTING.

During the ops period, contact will be maintained with CHESDIV via message or telephone. Documentation of daily activities will be in field log format. The logs will be compiled into a field site survey report upon return to CHESDIV. In order to facilitate reporting and message traffic, a grid system will be used to identify places on the island.

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